

September 24, 2009

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RE: Draft Sediment and Surface Water Sampling Plan
Patrick Bayou Superfund Site – Deer Park, TX

Dear Mr. Allen:

On behalf of the Patrick Bayou Joint Defense Group (JDG) and pursuant to the Administrative Settlement Agreement and Order on Consent (AOC) for Remedial Investigation/Feasibility Study (RI/FS) at the Patrick Bayou Superfund Site in Deer Park, TX, attached please find the draft Surface Sediment Contaminant of Potential Concern Delineation and Surface Water Sampling and Analysis Plan. As we've discussed, the JDG would appreciate a rapid response to allow a mid-October mobilization.

Should you have any questions please feel free to contact me at 919-435-0934.

Sincerely,

s/R Piniewski

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SURFACE SEDIMENT CONTAMINANT OF POTENTIAL CONCERN
DELINEATION AND SURFACE WATER SAMPLING AND ANALYSIS PLAN
PATRICK BAYOU SUPERFUND SITE REMEDIAL INVESTIGATION
DEER PARK, TEXAS

Prepared for

Patrick Bayou Joint Defense Group

Prepared by

Anchor QEA, LLC

2113 Government Street

Building D Suite 3

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September 2009

SURFACE SEDIMENT CONTAMINANT OF POTENTIAL CONCERN DELINEATION AND SURFACE WATER SAMPLING AND ANALYSIS PLAN

PATRICK BAYOU SUPERFUND SITE REMEDIAL INVESTIGATION DEER PARK, TEXAS

Prepared for

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LIST OF ACRONYMS AND ABBREVIATIONS

ACG	analytical concentration goal
AOC	Administrative Order on Consent
AVS/SEM	acid volatile sulfide/simultaneously extracted metal
cm	centimeter
COC	chain-of-custody
COPC	contaminants of potential concern
Cs-137	Cesium-137
CSM	Conceptual Site Model
DGPS	Differential Global Positioning System
DMP	Data Management Plan
DQO	Data Quality Objective
FFS	Focused Feasibility Study
FS	Feasibility Study
GPS	Global Positioning System
HDPE	high-density polyethylene
HSC	Houston Ship Channel
JDG	Patrick Bayou Joint Defense Group
NAD 83	North American Datum of 1983
ORP	oxidation reduction potential
PAH	polycyclic aromatic hydrocarbon
Pb-210	Lead-210
PCB	polychlorinated biphenyls
POC	points of contact
PPE	personal protective equipment
PQL	practical quantitation limit
PSCR	Preliminary Site Characterization Report
PTFE	polytetrafluoroethylene
PVC	polyvinyl chloride
QA	Quality Assurance

QA/QC	quality assurance/quality control
QAP	Quality Assurance Plan
QAPP	Quality Assurance Project Plan
RI	Remedial Investigation
SAP	Sampling and Analysis Plan
Site	Patrick Bayou Superfund Site
SOP	Standard Operating Procedures
SVOC	semivolatile organic compound
TCEQ	Texas Commission on Environmental Quality
TMDL	Total Maximum Daily Load
TOC	total organic carbon
USEPA	United States Environmental Protection Agency
VOC	volatile organic compounds

1 INTRODUCTION AND PURPOSE

This Sampling and Analysis Plan (SAP) describes the rationale, objectives, study design, and methods for an evaluation of the chemical concentrations in surface sediments and surface water at the Patrick Bayou Superfund Site (Site). The SAP is being conducted by the Patrick Bayou Joint Defense Group (JDG) in response to an Administrative Order on Consent (AOC) and Settlement Agreement with the U.S. Environmental Protection Agency (USEPA) dated January 31, 2006. The AOC concerns the performance of a Remedial Investigation/Feasibility Study (RI/FS) at the Site. The proposed data collection activities in this SAP were developed based on review of the results of Work Package 2 and Supplemental Work Plan evaluations, along with recent risk evaluations, sediment transport modeling, and mixing zone evaluation.

2 PROJECT MANAGEMENT

2.1 Task Organization

The JDG retained Anchor QEA, LLC (Anchor QEA) to perform the RI/FS. A comprehensive description of the project organization, schedule, and contacts is provided in the Quality Assurance Project Plan (QAPP; submitted as part of the RI Work Plan; Anchor 2007a). For this study, Anchor QEA will conduct the field work and data analysis. Table 1 provides an updated list of names and Quality Assurance (QA) responsibilities of key project personnel who will be involved in sampling and analysis activities described in this SAP.

3 SAMPLING DESIGN AND RATIONALE

The evaluations that are proposed in this SAP were developed to provide information that will allow further development of the Conceptual Site Model (CSM) and provide additional baseline data for the Site risk assessment and Focused FS (FFS). The investigation involves collection of surface sediment samples representative of the mixed/bioactive layer over the entire surface area of the Site. Information developed in the evaluation will be used to develop surface concentration maps of contaminants of potential concern (COPCs); these maps will subsequently be utilized in risk evaluations, including the exposure assessment for ecological receptors. Surface water samples will also be collected and analyzed to screen for COPCs as part of the SAP implementation to fill an existing data gap in regards to that exposure pathway.

3.1 Sampling and Analysis Objectives

This SAP recommends performing a Site-wide evaluation of the concentrations of Site COPCs in surface sediments representative of the mixing zone. Existing surface sediment data for COPCs are available from historical (primarily total maximum daily load [TMDL] evaluations) and RI/FS Work Package 2 investigations (0 to 11 cm), but additional surface sediment data are necessary to provide a spatially representative characterization of the distribution of COPCs at the Site. Based on the results of vertical characterization program in Work Package 2 and the preliminary results of the sediment transport model, surface concentrations of COPCs may have changed, and likely declined, over time due to attenuation and natural recovery. The proposed sampling strategy will provide a more comprehensive spatial characterization and reduce uncertainty in the statistical analysis of surface concentration estimates over the entire Site.

Prior to the Preliminary COPC Memorandum (PCOPC Memo; Anchor 2007c) and the COPC Screening Report (Anchor 2008a), data usability criteria were established through the *Performance and Acceptance Criteria Memo* (Anchor 2007b) to identify appropriate data. Data adequacy was then evaluated as part of the COPC screening process (Anchor 2008a). The evaluation performed for the COPC screening for surface water determined that enough data existed to appropriately select COPCs for metals and nutrients. For other chemicals, either only a limited number of samples (N=2) are available (i.e., dioxins), or there are no

data available that meet the performance and acceptance criteria (i.e., volatile organic compounds [VOCs], semivolatile organic compounds [SVOCs], polychlorinated biphenyls [PCBs], and pesticides). For these latter groups with limited or no Site data available, additional data are required in order to determine whether these chemicals should be considered Site COPCs. The limited or absent surface water data for these chemicals represents a data gap in the selection of COPCs and exposure assessment for Site receptors. Due to the high uncertainty that this data gap represents, additional surface water sampling for these classes of chemicals is proposed.

The objective of the surface water collection outlined in this SAP is to fill data gaps identified during previous data adequacy evaluations. Results of this evaluation will be used to identify and refine the existing COPC list and perform risk analyses.

3.2 Relationship to Other Activities

Patrick Bayou is a tributary of the Houston Ship Channel (HSC) in Harris County, Texas. The Site originates south of State Highway 225 in the City of Deer Park, Texas, and flows approximately 2.5 miles in a northerly direction, discharging into the south side of the HSC approximately 2.3 miles upstream of its confluence with the San Jacinto River (Figure 1). The Site and its salient features are described in more detail in the *Preliminary Site Characterization Report* (PSCR; Anchor 2006), the *Work Package 2 Hydrodynamic Field Data Collection and Contaminant Source Evaluation Data Report* (Work Package 2 Data Report; Anchor 2007d) and in the Site *Draft Selection of COPC for Ecological Risk Assessment* Technical Memorandum (Anchor 2008a).

Previous evaluations at the Site that are relevant to this SAP have focused on determining the vertical distribution of potential contaminants; collecting hydrologic and hydrodynamic information; developing a better understanding of sediment physical characteristics (Anchor 2007d); developing integrated Site watershed, hydrodynamic, and sediment transport models (Anchor QEA 2009); defining the Site list of COPCs (Anchor 2008a); and determining the depth of the sediment mixing zone at the Site (Anchor 2008b).

In the vertical characterization evaluation, sediment cores were collected at 14 stations using a 3-inch diameter piston core with a maximum penetration and recovery depth of approximately 8 feet. All cores were manually pushed to the full length of the core, or until refusal, whichever occurred first. Separate cores were collected at a subset of five stations for radiochemical analysis using Cesium-137 (Cs-137) and Lead-210 (Pb-210) in addition to the bulk chemistry cores. Each core was sectioned into various depth intervals for bulk sediment chemistry and radiochemistry analyses.

In addition, five data collection platforms were utilized at key inflow and outflow points across the Site to collect the field hydrologic data, and sediment cores were collected at 12 locations for the Sedflume testing to aid in the development of the Site hydrologic and sediment transport models. The modeling framework for this study consisted of three models that are linked together: 1) watershed (hydrology); 2) hydrodynamics (EFDC); and 3) sediment transport (SEDZLJ). These models were developed to evaluate sediment stability during high-flow events and changes in the bulk chemical composition of surface sediments associated with sediment deposition during multi-year periods (Anchor QEA 2009).

The effect of deposition of sediment from external sources on changes in sediment composition of the mixing-zone layer is being used to estimate the rate of changes in chemical concentration in the Site sediment bed in the sediment transport model (Anchor QEA 2009). Observations from the vertical coring investigations and sediment transport modeling indicate there is a significant amount of ongoing sedimentation at the Site involving a mixture of new sediment entering the Site and redistribution of on-site materials. In addition to providing a base map showing the current distribution of contaminants in surface sediments over the entire Site, the current understanding of how ongoing sediment transport and deposition at the Site affects current and future potential ecological and human health risk posed by COPCs in surface sediments will be refined based on the results of this investigation.

The sediment transport evaluations described above assumed the depth of the sediment mixing zone at the Site was 10 centimeters (cm). Although, the calibration steps used in the modeling to date indicate that a 10-cm mixing zone was an appropriate approximation at the locations evaluated as part of that effort, additional high resolution vertical profiling was

conducted at 10 locations (Anchor QEA 2009) to determine if this assumed depth of the mixing zone was a consistent and reliable estimate for the entire Site. The results of that evaluation confirmed that the maximum depth of the mixing zone is 10 cm and significantly less in some parts of the Site. USEPA and the Texas Commission on Environmental Quality (TCEQ) have concurred with this evaluation.

3.3 Sampling Schedule

The field investigation is currently expected to occur between October and November 2009. This schedule is subject to change based on agency approval of this sampling plan, weather delays, and other factors that may be unavoidable.

3.4 Documentation and Records

Complete and accurate records of data collection, data correction, and data analysis will be maintained. Integrity of this information will be maintained throughout all data transfers and manipulations. Procedures used to generate, transform, and validate data are critical for effective data management. A summary of the data management procedures are provided in the RI Work Plan QAPP and Data Management Plan (Anchor 2007a) and are incorporated into this sampling plan by reference.

4 METHODS AND PROCEDURES

The study design for this SAP is described in this section and depicted in Tables 2 and 3.

4.1 Experimental Design – Surface Sediments

A total of 47 locations at the Site are included in the surface sediment sampling program. This number is based on the projected amount of samples required to achieve an approximate 300-foot grid spacing coverage. Sample locations are identified in Figure 2 and Table 2. The 0 to 10 cm sampling depth interval proposed is conservative, based on the analysis of the *Mixing Zone Evaluation Work Plan* data and agreed upon with USEPA, TCEQ, and the Trustees.

4.1.1 Target Analytes

Samples collected during this task will be submitted to an analytical laboratory for analysis according to the sample design summary provided in Table 2. Chemicals identified as either COPCs or Uncertain COPCs for sediment direct contact or bioaccumulative effects in the *Selection of contaminants of potential concern for ecological risk assessment technical memorandum* (Anchor 2008a) and Amendment (Anchor 2008b) are included in the laboratory analysis. The COPCs include:

- Ammonia
- Total metals (identified in Table 4)
- Polycyclic aromatic hydrocarbons (PAHs) and SVOCs (identified in Table 4)
- Volatile organic compounds VOCs (identified in Table 4)
- PCB congeners
- Pesticides (identified in Table 4)
- Dioxins and furans (identified in Table 4)

PCBs will be evaluated on a PCB congener basis only. It is expected that PCB congener results from surface sediment collection will provide the most appropriate dataset to calculate potential ecological or human health risks, as opposed to PCB Aroclors, which commonly have significant analytical method detection limit issues in complex sediment matrices.

In addition to the chemicals listed in Table 4, several other parameters will be measured to aid in interpretation of the chemical data and to characterize the geotechnical properties of the Site for the FFS. Those parameters include:

- Total organic carbon (TOC) – all samples
- Acid volatile sulfide/simultaneously extracted metal (AVS/SEM) – 50 percent of all samples (every other station on a spatial basis)
- Grain size – 50 percent of all samples (every other station on a spatial basis)
- Specific gravity – approximately 1/3 of all samples (every other station on a spatial basis)

4.2 Experimental Design – Surface Water

Surface water collection will be conducted separately from the sediment collection during a distinct mobilization effort to avoid potential interferences from suspended particulate materials associated with the sediment sampling. The surface water study design was created to meet the objectives of this SAP. TCEQ guidance for water collection (Chapter 5 in TCEQ 2003) was also consulted.

4.2.1 Sample Locations, Frequency, and Intervals

Six locations at the Site are included in the surface water collection program (Figure 3). The locations of the samples were chosen to characterize water from outside sources, including the HSC, outfalls from OxyVinyls, the East Fork Tributary, and upstream water (i.e. south of State Highway 225). Samples will be collected from mid-depth as determined in the field and approximately 6 inches from the bottom at each location. Collection will occur during two tidal events, one at approximately slack low tide (the time surrounding the nadir of the tide) and the second at approximately mid-tide (on an outgoing tide). At the suggestion provided in TCEQ (2003), sampling will be delayed for at least 48 hours after a heavy rainfall event, to be defined as greater than 1 inch per 24-hour period for the purposes of this work.

4.2.2 Target Analyte List

Surface water samples collected during this task will be submitted to an analytical laboratory for analysis according to the sample design summary provided in Table 3. As discussed in

Section 3.1, metals (excepting selenium and mercury) and nutrients (excepting total Kjeldahl nitrogen) were eliminated from the COPC list during screening (Anchor 2008a and 2008b). For other chemicals, COPC status is considered either uncertain or unknown. Surface water will be analyzed for all potential COPCs listed in Table 5. The target analyte list for SVOCs, VOCs, pesticides, PCBs, dioxins and furans, and conventional water quality parameters was taken from the USEPA Superfund program (USEPA 2008). Selenium, mercury, and total Kjeldahl nitrogen will also be included in the laboratory analysis (Table 5). Filtered water will be collected for analysis of dissolved metals, as TCEQ and USEPA criteria that will be used in COPC screening are based on dissolved fractions. All other chemicals will be analyzed from unfiltered water.

5 LABORATORY ANALYTICAL METHODS, QUALITY CONTROL, AND MEASUREMENT QUALITY OBJECTIVES

Analytical methods and the associated method reporting limits for sediment samples collected as part of this SAP are listed in Table 4. For comparison purposes, TCEQ sediment screening benchmarks (TCEQ 2006) and risk-based bioaccumulation values are listed as analytical concentration goals (ACG). Analytical methods, target practical quantitation limits (PQL), and ACG for surface water samples are provided in Table 5.

A summary of laboratory quality control samples and frequency of analysis for sediment sampling are listed in Table 6 and for surface water in Table 7.

Laboratory measurement quality objectives for precision, accuracy, and completeness of sediment chemistry analysis for this SAP are listed in Table 8 for sediment and Table 9 for surface water.

6 FIELD ACTIVITY METHODS AND PROCEDURES

Details regarding project organization, schedule, contacts, access, utility clearance, and equipment are provided in this section.

6.1 Project Organization, Schedule, and Contacts

A comprehensive description of the project organization, schedule, and contacts is provided in the QAPP (submitted as part of the RI Work Plan; Anchor 2007a). For this study, Anchor QEA will conduct the field work.

6.2 Access and Sampling Permission

Anchor QEA will identify access and permit requirements prior to field crew mobilization and coordinate with individual private property owners concerning specific sampling dates once access agreements have been executed.

The Site will be accessed through four privately owned facilities: Shell Oil – Deer Park Refining Services, Shell Chemical L.P. – Deer Park Chemical Plant, Lubrizol Corporation, and OxyVinyls L.P. The following personnel are facility-specific points of contact (POC) that will oversee the field activities occurring at their respective facilities:

- Jeff Stevenson– Shell Chemical – Deer Park Chemical Plant
- Norman Mollard – Lubrizol Corporation
- Jeff Adamski – OxyVinyls L.P.

6.3 Utility Clearances

The nature of sampling activities is unlikely to create a hazard due to underground utilities or submerged pipelines; however, intrusive subsurface sampling activities will not be performed near any known or observable structures. Due to the industrial nature of the Site, it is not anticipated that any residential underground utilities will exist at the proposed sampling sites. Location of underground utilities will be coordinated with industrial facilities located along the Site boundaries. If underground or submerged utilities are present at a specific sampling location, the sampling location will be moved to avoid the utility.

6.4 Equipment, Supplies, and Sampling Containers

The analytical laboratory will provide certified, pre-cleaned, USEPA-approved containers for all samples. Prior to shipping, the analytical laboratory will add preservative, where required, according to USEPA protocols. Sample containers for sediment and surface water are described in Tables 10 and 11, respectively.

Necessary equipment, supplies, and sampling containers will be shipped or carried to the Site. Equipment and supplies may be shipped directly to the field from the vendor or to Anchor QEA's Gulf Coast office for inspection prior to deployment or use in the field at the Site. All equipment and supplies will be inspected and tested as needed prior to field use.

6.5 Surveying

Horizontal positioning at each sampling location will be determined using a differential global positioning system (DGPS) with a handheld global positioning system (GPS) unit as backup if necessary. Station positions will be recorded in latitude and longitude to the nearest 0.01 second in the North American Datum 1983 (NAD 83). The accuracy of the horizontal coordinates will be within 3 meters.

6.6 Sample Collection Procedures

The following subsections describe the procedures for collecting surface sediment and surface water samples.

6.6.1 Surface Sediment Sampling

The targeted sample depth will be from the surface of the sediment-water interface to 10 cm below the surface for sediment chemistry samples, except for AVS/SEM samples. AVS/SEM samples will be taken from very near surface sediments within the top 2 cm of grab samples described below. To reach the 0 to 10 cm target depth for sediment chemistry samples and collect only sediment from this depth interval, the box-core sampler utilized in the *Mixing Zone Evaluation Work Plan* (Anchor 2008b) will be used for this effort.

The box-core sampler will be manually driven to a depth that ensures the top 10 cm of sediment inside the core is undisturbed. Multiple discrete cores may be required to collect the necessary volume for the proposed analyses. If multiple cores required, care will be taken to sample in a method that ensures a minimal chance of potential cross-contamination of near surface sediments. This can be accomplished by obtaining cores on opposite sides of the sampling platform/boat and across current, rather than downcurrent.

Prior to sampling, the box cores will be decontaminated according to the procedures outlined in Section 6.8. Contact of the box core with potentially contaminated surfaces will be avoided or minimized to the extent possible during sampling. Extra box cores will be available during sample operations for uninterrupted sampling in the event of a potential core breakage or contamination. Box cores suspected to have been accidentally contaminated will not be used. During deployment and retrieval of the coring device, care will be taken to ensure that the end of the core does not become contaminated. When retrieved, each core will be inspected and a physical description of the material in the core will be recorded.

Sediment cores will be inspected after they are secured on board the sampling vessel. Cores will be evaluated for acceptability using the following criteria:

- The sediment surface is relatively undisturbed
- The sampler was not inserted at angle or tilted upon retrieval based on a visual inspection of the coring unit
- At least 80 percent core recovery versus penetration is achieved

If a core fails to meet any of the above criteria, it will be rejected and the sediment will be placed back into the sampling area after acceptable sediments are retrieved. Sediment cores that meet the above-stated criteria will be processed as described in Section 6.7.

Sediments will also be collected for evaluation of AVS/SEM, grain size, and specific gravity at required stations using a small Ekman dredge grab sampler or a similar device. These samples will be taken after collection of the chemistry core sample to minimize potential chemical cross-contamination of the sediment surface. The grab sampler will be deployed

and retrieved at a rate of approximately 1 foot per second to minimize contacting the bottom at an angle and potential disturbance of the sediment surface within the sampler.

Following retrieval of the grab sample, the sampler will be braced in an upright position. The flaps will be opened and the overlying water will be slowly removed using a siphon. If excessive water leakage is indicated by the lack of an overlying water layer, the sample will be rejected. Each grab sample will be visually characterized using the following additional criteria to determine if the sample is acceptable:

- Sediment is not leaking from the flaps
- Sediment surface appears to be relatively undisturbed (i.e. minimal winnowing)

Samples that do not meet any one of the above criteria will be rejected, and the sample will be recollected.

Sample collection activities will begin at the most downstream location (at the mouth of the bayou) and proceed upstream to minimize any potential for sample interference caused by disturbed sediment.

6.6.2 Surface Water Sampling

Water samples will be collected using a horizontal van Dorn bottle (or a similar type of surface water sampler). Collection of water using a van Dorn bottle is listed as a potential method in TCEQ 2003. The sampler will be lowered to the target water depth on a rope, allowed to sit at the target depth for a short period to allow any mudline particulates potentially disturbed during the deployment to settle out, and will be triggered to close by the deployment of a messenger.

Samples will be collected from mid-depth as determined in the field and approximately 6 inches from the bottom at each location. The depths will be determined using a fathometer or a lead line. If mid-depth is within 1 foot of the mudline, (i.e., water depth is less than 2 feet), water will be collected from a depth equal to one-third the water depth, per TCEQ guidance (TCEQ 2003) in lieu of mid-depth samples. If excessive turbidity (relative to the natural turbidity of the water for that day) is observed in a collected sample, the sample will

be discarded, and the sampler will be redeployed and allowed additional time for the disturbed bottom sediment to clear before triggering the sampler.

Field parameters will be measured at each sample location (at approximately the same sample depth that the surface water sample is collected from) in the field using a water column-deployed Hydrolab MS5 Water Quality Multiprobe or similar equipment. At each measurement location, the water quality multiprobe will be lowered to the target depth and allowed to equilibrate for 30 seconds or until readings have stabilized. Measurements of pH, temperature, turbidity, oxidation reduction potential (ORP or Eh), conductivity, and dissolved oxygen will be recorded on a field measurement log sheet.

6.7 Sediment Processing

The following subsections detail the sample processing procedures for sediment collection and surface water collection. All working surfaces and instruments used in the processing area will be thoroughly cleaned, decontaminated, and covered with aluminum foil to minimize outside contamination between sampling events (see Section 6.8). Disposable gloves will be discarded after processing each station and replaced prior to handling decontaminated instruments or work surfaces.

Sample containers will be kept in packaging as received from the analytical laboratory until use; a sample container will be withdrawn only when a sample is to be collected and will be returned to a cooler containing completed samples. Table 10 indicates holding times and preservatives.

6.7.1 Surface Sediment Samples

The surface sediment samples collected in this sampling event will be processed as follows:

- The general description (including penetration and recovery) of the core or grab sampler will be recorded on the appropriate log form.
- Grab samples for AVS/SEM will be processed at the time of sampling by scooping the top oxidized layer of sediments from the surface of the sample with a maximum planned sample depth of 2 cm. These samples will be placed directly into a 4-ounce glass sample jar and filled so there is no head space and capped.

- Grab samples for grain size and specific gravity analysis will also be processed at the time of sampling by scooping the top 10 cm of sediment directly into appropriate sample containers.
- For chemistry samples in the box cores, the top 10 cm of sediment will be extruded into a pre-cut 10-cm template that fits on top of the core, and the core will be cut using a thin stainless steel plate. Care will be taken to not sample sediment that is in contact with the tube or sample device (box-core sampler) by only collecting sediments from the center of the core.
- For collection of sediment for VOC analysis, a discrete grab from the center of the 10 cm sample interval will be collected and placed directly into a 2 ounce sample container and filled so there is no head space and capped immediately.
- If multiple box-core deployments are conducted: 1) an equal amount of sediment will be collected (using a scoop) from each core and combined directly into the sample container for VOC analysis; and 2) the remaining sediment will be combined from each core into a stainless steel bowl for homogenization.
- Samples will be homogenized in the field. Samples will be homogenized prior to placing in the sample containers. The general procedure will consist of:
 - Removing unrepresentative materials (twigs, shells, leaves, etc.) and documenting in the appropriate field log
 - Quickly and efficiently mixing the sample
 - Stirring the sediment until texture, color, and moisture homogeneity is achieved
- Using a clean, stainless steel spoon, pre-labeled sample containers will be completely filled, as indicated in Table 10.
- Immediately after filling the sample containers with sediment, the screw cap will be placed on the sample container and tightened, wiping jar threads as necessary to ensure a tight seal.
- All sample containers will be thoroughly checked for proper identification, analysis type, and lid tightness.
- Each container will be packed carefully to prevent breakage and placed inside of a cooler with ice for storage at the proper temperature (4°C for all samples).

6.7.2 Surface Water Sample Processing

Water sample processing will occur directly after collection. The sampler may require a second deployment at each station if additional volume is needed to fill the required sample containers.

The specific steps are outlined as follows:

- For collection of VOC samples:
 - Immediately following retrieval of the sampler to the surface, pour the collected surface water directly into appropriate pre-labeled sample containers, as outlined in Table 11. The sampling container should be free of all head space and capped immediately to minimize the potential for volatilization loss.
- For collection of unfiltered water:
 - Following collection of water for VOC analysis, pour the collected water into the appropriate sample containers, as outlined in Table 11.
- For collection of dissolved metal samples:
 - Filter water within 15 minutes of collection, if feasible, per TCEQ 2003.
 - Use a Geotech peristaltic pump to force water through a 0.45-micron filter dedicated to each sample directly into the appropriate sample container, as outlined in Table 11. An amount of sample water equal to the tubing and filter volume will be purged through the filter and tubing prior to sample collection.
 - Collect one filter blank sample to evaluate the potential for cross-contamination during the field filtration procedure.
 - Filter laboratory supplied deionized water directly into a complete set of sampling containers using a separate unused dedicated filter and tubing assembly.

6.8 Decontamination

Decontamination procedures are outlined below for sediment and surface water sampling.

6.8.1 Sediment Sampling

Sample collection equipment, containers, instruments, working surfaces, technician protective gear, and other items that may come into contact with sediment sample material must meet high standards of cleanliness. All equipment and instruments used that are in direct contact with the sediment collected for analysis will be made of glass, stainless steel, high density polyethylene (HDPE), or polytetrafluoroethylene (PTFE), and will be cleaned prior to each day's use and between sampling or handling. Decontamination of all items will follow USEPA protocols (1986). The decontamination procedure is as follows:

- Pre-wash rinse with tap water or site water
- Wash with solution of tap water and Alconox soap (brush)
- Rinse with tap water
- Rinse three times with distilled water
- Cover (no contact) all decontaminated items with aluminum foil
- Store in clean, closed container for next use

The Field Supervisor may elect to implement a hexane rinse if there are significant residues observed on field equipment after the above decontamination procedures are used.

6.8.2 Water Sampling

To prevent sample contamination, water sampling equipment will undergo the following decontamination procedures between each sampling station:

- Wash with phosphate-free detergent and tap water using a scrub brush
- Rinse with deionized water

For all filtered water samples, a dedicated filter will be used for each sample and discarded after each sample is filtered. In addition, dedicated pump tubing will be used for each station. Between samples at a station, the tubing will be flushed with deionized water prior to each sample being pumped, and a small amount of sample volume will be purged to ensure that all deionized water has been removed from the tube.

6.9 Field Quality Assurance/Quality Control (QA/QC)

6.9.1 Field Quality Assurance Samples

Per the RI Work Plan QAPP (Anchor 2007a), field duplicates will be sampled and submitted for analysis at a frequency of 5 percent of samples submitted for bulk sediment chemistry. Temperature indicators will be included in each container for shipment of bulk sediment chemistry to the laboratory. Equipment rinsate blanks/field blank samples for VOC analysis will be collected according to the procedures described in Table 11-1 of the RI Work Plan QAPP (Anchor 2007a). Trip blanks will be included in each shipment of VOC samples to the laboratory. Trip blanks will be handled according to the procedures described in Table 11-1 of the RI Work Plan QAPP (Anchor 2007a).

6.9.2 Performance Audits and Corrective Actions

Performance audits and corrective actions will be performed per the RI Work Plan QAPP (Section 16; Anchor 2007a)

6.10 Investigation-Derived Waste Handling and Tracking

This section provides a waste management plan for handling investigation-derived waste associated with activities at the Site.

Investigation-derived waste for this SAP is expected to consist of:

- Excess sediment generated during sampling (cores and slurries)
- Personal protective equipment (PPE) and other solid waste
- Decontamination and rinse water

6.10.1 Sediment

Generation of some excess sample material is anticipated during collection of cores. Whenever possible, core material will be returned to the environment by returning the sediment back to the collection site (Patrick Bayou).

Field sampling conditions may preclude safe disposal of excess material at the time of sampling. If needed, excess sediments and slurries will be retained and stored in lined 10-gallon buckets for later return to the environment at the Site.

If needed, sediments and slurries will be retained and stored in lined 50-gallon drums for later disposal at an approved solid waste handling facility. Contents of the drums will be clearly marked. A log of collection dates and times, plus approximate volume of each sample, will be maintained to facilitate off-site disposal of the material as either non-hazardous or hazardous dredge spoil material.

6.10.2 Decontamination and Rinse Water

Decontamination and rinse water will be retained in lined 10-gallon buckets, and disposed of via the municipal sewer system if processing and decontamination occurs in the field. If processing and decontamination occurs in an on-site laboratory facility, decontamination and rinse water will be discharged directly into a sink tied to the municipal sewer system. Dilution of COPCs by flushing with tap water and the additional dilution of COPCs by other sources of flow in the municipal sewer system should be sufficient to achieve non-hazardous levels or no appreciable increase in ambient COPCs.

Excess water from surface water grab sample collection will be returned to the Site.

6.10.3 PPE and Other Solid Waste

PPE and other solid waste will be decontaminated to the extent possible and disposed as municipal waste. If needed, PPE and solid waste with excess sediment or slurry contamination will be retained and stored in lined 10-gallon buckets. Retained PPE and solid waste will be stored in lined 50-gallon drums for later disposal at an approved solid waste handling facility. Contents of the drums will be clearly marked. A log of collection dates and times, plus approximate volume of the waste, will be maintained to facilitate off-site disposal of the material as either non-hazardous or hazardous material.

7 MEASUREMENT AND DATA ACQUISITION

This section describes the procedures for field documentation, sample identification, and handling/transporting sediment and surface water samples to the analytical laboratory.

7.1 Field Documentation and Sediment Sample Identification

Field sample logs and notebooks will be maintained for all samples collected during the field program. All sample field notebooks will have numbered pages. All data entries will be made using indelible-ink pens. Corrections will be made by drawing a single line through the error, writing in the correct information, then dating and initialing the change.

At a minimum, the following information will be included in the log for sediment cores:

1. The sample station number
2. Location of each sample station as determined by DGPS (with proper description of measurement units)
3. Date and collection time of each sediment sample
4. Names of Field Supervisor and person(s) collecting and logging the sample
5. Observations made during sample collection including: weather conditions, complications, and other details associated with the sampling effort
6. Length and recovery for each sediment core
7. Qualitative notation of apparent resistance of sediment column to coring/sampling, including notes on debris
8. Any deviation from the approved SAP

During sediment sample processing, the following information should be recorded in the sample logsheet or field log:

1. Sample recovery (depth in feet of penetration and sample compaction)
2. Physical soil description in accordance with the Unified Soil Classification System (includes soil type, density/consistency of soil, and color)
3. Odor (e.g., hydrogen sulfide, petroleum, etc.) if any is passively observed
4. Vegetation
5. Debris

6. Biological activity (e.g., detritus, shells, tubes, bioturbation, or live or dead organisms)
7. Presence and depth (in feet) of the redox potential discontinuity layer
8. Presence of oil sheen
9. Any other distinguishing characteristics or features

7.1.1 Sediment Sample Identification

Sample identification will include depth interval information and will follow the general project identification scheme for sediment and grabs described below. For example, for sample PB###-#XX###-X:

- PB###-#XX###-X: Each location will be identified by PB, to depict the project location (Patrick Bayou), and the station identifier associated with the channel station in hundreds of feet (e.g., PB100). Samples collected in the East Fork will be designated with EF.
- PB###-#XX###-X: Individual samples at each location will be identified by the same alphanumeric identifier used to identify the stations, followed by a one-digit numeric substation identifier, a two-digit matrix identifier (i.e., SS = surface sediment grab), and a three-digit number identifying the lower interval measurement (in cm) for that sample.
- PB###-#XX###-X: An alphanumeric identifier indicating the sample type:
 - N – normal sample
 - D – field duplicate or homogenization split of the normal sample

This information is included in detail for planned samples in Table 2. For samples collected from stations previously sampled, the unique substation identifier within the identification scheme will distinguish from previously collected data, as will the sample collection date, depth, and time associated with the sample.

7.2 Field Documentation and Surface Water Sample Identification

Field sample logs and notebooks will be maintained for surface water samples collected similar to the procedures for sediment collection.

At a minimum, the following information will be included in the log for surface water grabs:

1. The sample station number
2. Location of each sample station as determined by DGPS (with proper description of measurement units)
3. Date and collection time of each water sample
4. Names of Field Supervisor and person(s) collecting and logging the sample
5. Observations made during sample collection including: weather conditions, bayou conditions, complications, and other details associated with the sampling effort
6. Water depth and sample depth
7. Position in tidal event (e.g., time before or after low tide)
8. Any deviation from the approved SAP

7.2.1 Surface Water Sample Identification

A general project identification scheme for surface water samples was not previously identified for Patrick Bayou. Sample identification for surface water samples will include depth interval information and will follow a scheme similar to the one for sediment cores as described below. For example, for sample PB###-#XX###-X:

- PB###-#XX###-X: Each location will be identified by PB, to depict the project location (Patrick Bayou), and the station identifier associated with the channel station in hundreds of feet (e.g., PB100). Samples collected in the East Fork will be designated with EF.
- PB###-#XX###-X: Individual samples at each location will be identified by the same alphanumeric identifier used to identify the stations, followed by a one-digit numeric substation identifier, a two-digit matrix identifier (i.e., SW= surface water grab), and a three-digit number identifying the interval measurement (in meters) for that sample.
- PB###-#XX###-X: An alphanumeric identifier indicating the sample type:
 - N – normal sample
 - D – field duplicate or homogenization split of the normal sample

This information is included in detail for planned samples in Table 3. For samples collected from stations previously sampled, the unique substation identifier within the identification

scheme will distinguish from previously collected data, as will the sample collection date, depth, and time associated with the sample.

7.3 Sample Handling and Transport

As described in the RI Work Plan QAPP (Anchor 2007a), components of sample custody procedures include the use of field logbooks, sample labels, custody seals, and chain-of-custody (COC) forms. Each person involved with sample handling will be trained in COC procedures before the start of the field program. The COC form will accompany the samples during shipment from the field to the laboratory.

7.3.1 Field Custody

The following procedures will be used to document, establish, and maintain custody of field samples:

1. Sample labels will be completed for each sample with waterproof ink, making sure that the labels are legible and affixed firmly on the sample container.
2. All sample-related information will be recorded in the project logbook.
3. The field sampler will retain custody of the samples until they are transferred or properly dispatched.
4. To simplify the COC record and minimize potential problems, as few people as possible should handle the samples. For this reason, one individual from the field sampling team will be designated as the responsible individual for all sample transfer activities. This field investigator will be responsible for the care and custody of the samples until they are properly transferred to another person or facility.
5. A COC form will accompany all samples. This record documents the transfer of custody of samples from the field sampler to the laboratory. When transferring the possession of samples, the individuals relinquishing and receiving will sign, date, and note the time on the record.
6. Samples will be properly packaged for shipment and sent to the appropriate laboratory for analysis with a separate signed COC form, enclosed in a plastic bag, and taped inside the cover of each sample box or cooler. The original record will accompany the shipment, and a copy will be retained by the Field Supervisor. When

samples are relinquished to shipping companies for transport, the tracking number will be recorded on the COC form.

7. The COC must be signed when relinquished by field personnel and signed by the laboratory receiving the samples.
8. Custody seals will be used on the shipping containers when samples are shipped to the laboratory to inhibit sample tampering during transportation.

7.3.2 Laboratory Sample Custody

Each laboratory receiving samples for this project must comply with the laboratory sample custody requirements outlined in its Quality Assurance Plan (QAP). The laboratory will designate a sample custodian who will be responsible for maintaining custody of the samples and all associated records documenting that custody. In addition, the laboratory will provide the following quality checks:

- The laboratory will check to see that there has been no tampering with the custody seals on the coolers.
- Upon receipt of the samples, the custodian will check the original COC and request-for-analysis documents and compare them with the labeled contents of each sample container for corrections and traceability. The sample custodian will sign the COC and record the date and time received in the 'Received by Laboratory' box.
- The sample custodian also will assign a unique laboratory sample number to each sample.
- Cooler temperature will be checked and recorded.
- Care will be exercised to annotate any labeling or descriptive errors. If discrepancies occur in the documentation, the laboratory will immediately contact the sample tracking coordinator and Anchor QEA QA Manager as part of the corrective action process. A qualitative assessment of each sample container will be performed to note anomalies, such as broken or leaking bottles. This assessment will be recorded as part of the incoming COC procedure.

Samples will be stored in a secured area and at a temperature of $4^{\circ} \pm 2^{\circ}\text{C}$, if necessary, until analyses are to begin. Unless otherwise specified by the Project Manager, samples will be retained for a period of 60 days after the final report is released by the laboratory, after

which they will be disposed in accordance with the laboratory Standard Operating Procedures (SOP) for waste disposal. Samples submitted to the laboratory marked for archive on the COC and sample container will be frozen and stored until further notice.

7.3.3 Sample Packing and Shipping

During the field efforts, the Anchor QEA QA Manager will notify the appropriate laboratories about sample shipments. The Anchor QEA Field Supervisor will fax copies of the COC to the Laboratory Project Manager for each day of sampling.

Hard plastic ice chests or coolers with similar durability will be used for shipping samples. The coolers must be able to withstand a 4-foot drop onto solid concrete in the position most likely to cause damage. Samples will be double-bagged in Ziploc bags and grouped by sample set. Styrofoam or bubble wrap will be used as packing material to protect the samples from leakage during shipment. A volume of ice approximately equal to the sample volume should be present in each cooler. Blue ice will not be used. After packing is complete, the cooler will be taped securely, with custody seals affixed across the top and bottom joints. In addition, these procedures will be followed when packing coolers of samples for shipping:

1. Include absorbent material in the cooler to absorb any ice melt.
2. Record the airbill on each COC.
3. List the appropriate contact person on the COC.
4. Use custody seals on the cooler.

Samples will be shipped priority overnight FedEx or transported by courier (or equivalent) to the laboratory.

8 REFERENCES

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TABLES

Table 1
Project Personnel Quality Assurance Responsibilities – Updated

Title	Responsibility	Name/ Affiliation	Contact information
Project Coordinator	Responsible for coordination of schedule, budget, and facilitating technical discussions between agencies, Anchor QEA, and Patrick Bayou Joint Defense Group.	Bob Piniewski	Project Navigator 70 Traylee Wake Forest, NC 27587 bobp@projectnavigator.com
Anchor QEA Project Director	Responsible for the overall delivery of project objectives in alignment with the operating parameters set forth in the project QAPP.	Tom Schadt	Anchor QEA, LLC 1423 Third Avenue, Suite 300 Seattle, WA 98101 (206) 287-9130 tschadt@anchorqea.com
Anchor QEA Project Manager	Responsible for the coordination and execution of all work items associated with project planning and implementation. Liaison between program-level managers and project-level team members. Identifies team members and project assignments. Manages and tracks schedule and budget. Ensures that all tasks are completed by assigned team members within schedule and budget constraints.	David Keith	Anchor QEA, LLC 2113 Government Street Building D, Suite 3 Ocean Springs, MS 39564 (228) 818-9626 dkeith@anchorqea.com
Anchor QEA Project Health and Safety Manager	Responsible for overseeing health and safety program for field tasks associated with RI/FS. Reviews Site Health and Safety Plan, Site job safety analyses and training requirements.	Chris Torell	Anchor QEA, LLC 290 Elwood Davis Road Suite 318 Liverpool, NY 13088 (315) 451-1905 ctorell@anchorqea.com
Anchor QEA Project QA Manager	Responsible for Data Quality Objective (DQO) planning, QAPP development, ensuring the project objectives are met. Liaison between project manager and project team. Task lead for data interpretation and final report preparation.	Delaney Petersen	Anchor QEA, LLC 1423 Third Avenue, Suite 300 Seattle, WA 98101 (206) 287-9130 dpetersen@anchorqea.com
Anchor QEA Data Manager (DM)	Point of contact for all issues concerning database maintenance, data loading, verifying data, and communicating with project team regarding database and data content issues.	Lisa Allen	Anchor QEA, LLC 1423 Third Avenue, Suite 300 Seattle, WA 98101 (206) 287-9130 lallen@anchorqea.com

Title	Responsibility	Name/ Affiliation	Contact information
Field Supervisor	Responsible for field data collection. In addition, the Field Supervisor will implement the Health and Safety Plan in the field.	Jason Kase	Anchor QEA, LLC 7139 N 9th Ave, Suite F Pensacola, FL 32504 (850) 912-8400 jkase@anchorqea.com
Project Emergency Coordinator	Responsible for managing potential emergency situations during field work for the RI/FS. Includes notifying appropriate Points of Contact at each facility and the Project Manager in case of fire, spills, personal injury, or any other emergency situation that may arise.	Jason Kase	Anchor QEA, LLC 7139 N 9th Ave, Suite F Pensacola, FL 32504 (850) 912-8400 jkase@anchorqea.com
Vessel Operator	Responsible for the safe operation of boats or other sampling platforms utilized during sampling and maintenance activities. Will ensure that proper safety equipment is on the vessel and operating correctly and that all personnel on the boat are familiar with safety procedures, features, and equipment.	To Be Determined	

Bold titles indicate changes/additions to project QAPP (Anchor 2007a).

Table 2
Summary of Surface Sediment Sampling Study Design

Station ID ^c	Sample ID	Depth Interval (cm) ^{c,*}	Station Coordinates ^a		Mercury	Total Metals ^b	Dioxins/Furans ^b	PCB Congeners ^b	Pesticides ^b	SVOCs ^b	VOCs ^b	Ammonia	TOC	Grain Size	Specific Gravity	AVS/SEM
			Northing	Easting												
PB001.1	PB001.1-1SS0##-N	0-10	13836552.43	3202381.97	X	X	X	X	X	X	X	X	X	X		X
PB001.2	PB001.2-1SS0##-N	0-10	13836553.57	3202625.34	X	X	X	X	X	X	X	X	X			
PB001.3	PB001.3-1SS0##-N	0-10	13836490.45	3202787.01	X	X	X	X	X	X	X	X	X	X	X	X
PB002	PB002-1SS0##-N	0-10	13836425.44	3202594.96	X	X	X	X	X	X	X	X	X			
PB004	PB004-1SS0##-N	0-10	13836352.28	3202328.25	X	X	X	X	X	X	X	X	X	X		X
PB005	PB005-1SS0##-N	0-10	13836136.27	3202271.92	X	X	X	X	X	X	X	X	X			
PB007.1	PB007.1-1SS0##-N	0-10	13836306.09	3202053.29	X	X	X	X	X	X	X	X	X	X		X
PB007.2	PB007.2-1SS0##-N	0-10	13836110.06	3202029.20	X	X	X	X	X	X	X	X	X			
PB009	PB009-1SS0##-N	0-10	13836108.71	3201749.23	X	X	X	X	X	X	X	X	X	X		X
PB011	PB011-1SS0##-N	0-10	13836244.44	3201735.16	X	X	X	X	X	X	X	X	X			
PB013.1	PB013.1-1SS0##-N	0-10	13836249.82	3201425.28	X	X	X	X	X	X	X	X	X	X		X
PB013.2	PB013.2-1SS0##-N	0-10	13836105.65	3201405.80	X	X	X	X	X	X	X	X	X			
PB015	PB015-1SS0##-N	0-10	13836230.01	3201229.15	X	X	X	X	X	X	X	X	X	X		X
PB016	PB016-1SS0##-N	0-10	13836038.72	3201167.39	X	X	X	X	X	X	X	X	X			
PB018	PB018-1SS0##-N	0-10	13835750.98	3201142.48	X	X	X	X	X	X	X	X	X	X		X
PB019	PB019-1SS0##-N	0-10	13835720.29	3201295.23	X	X	X	X	X	X	X	X	X			
PB022	PB022-1SS0##-N	0-10	13835452.30	3201146.26	X	X	X	X	X	X	X	X	X	X		X
PB023	PB023-1SS0##-N	0-10	13835425.16	3201312.63	X	X	X	X	X	X	X	X	X			
PB024	PB024-1SS0##-N	0-10	13835178.89	3201174.20	X	X	X	X	X	X	X	X	X	X	X	X
PB026	PB026-1SS0##-N	0-10	13835149.61	3201330.20	X	X	X	X	X	X	X	X	X			
PB028	PB028-1SS0##-N	0-10	13834855.91	3201353.90	X	X	X	X	X	X	X	X	X	X		X
PB032	PB032-1SS0##-N	0-10	13834548.09	3201369.64	X	X	X	X	X	X	X	X	X			
PB034	PB034-1SS0##-N	0-10	13834246.36	3201385.46	X	X	X	X	X	X	X	X	X	X		X
PB037	PB037-1SS0##-N	0-10	13833932.48	3201401.62	X	X	X	X	X	X	X	X	X			
PB041	PB041-1SS0##-N	0-10	13833637.14	3201405.92	X	X	X	X	X	X	X	X	X	X		X
PB043	PB043-1SS0##-N	0-10	13833348.09	3201452.56	X	X	X	X	X	X	X	X	X			
PB044	PB044-1SS0##-N	0-10	13833281.75	3201660.08	X	X	X	X	X	X	X	X	X	X		X
PB047.1	PB047.1-1SS0##-N	0-10	13833046.91	3201457.99	X	X	X	X	X	X	X	X	X			
PB047.2	PB047.2-1SS0##-N	0-10	13833059.83	3201658.83	X	X	X	X	X	X	X	X	X	X		X
PB048	PB048-1SS0##-N	0-10	13832865.33	3201635.88	X	X	X	X	X	X	X	X	X			
PB049	PB049-1SS0##-N	0-10	13832759.40	3201432.66	X	X	X	X	X	X	X	X	X	X	X	X
PB053	PB053-1SS0##-N	0-10	13832451.69	3201425.83	X	X	X	X	X	X	X	X	X			
PB056	PB056-1SS0##-N	0-10	13832156.38	3201476.36	X	X	X	X	X	X	X	X	X	X		X
PB057	PB057-1SS0##-N	0-10	13832081.61	3201634.43	X	X	X	X	X	X	X	X	X			
PB059.1	PB059.1-1SS0##-N	0-10	13831856.07	3201526.74	X	X	X	X	X	X	X	X	X	X		X
PB059.2	PB059.2-1SS0##-N	0-10	13831858.56	3201638.87	X	X	X	X	X	X	X	X	X			
PB063.1	PB063.1-1SS0##-N	0-10	13831533.66	3201503.45	X	X	X	X	X	X	X	X	X	X		X
PB063.2	PB063.2-1SS0##-N	0-10	13831550.32	3201599.45	X	X	X	X	X	X	X	X	X			
PB064	PB064-1SS0##-N	0-10	13831285.32	3201625.99	X	X	X	X	X	X	X	X	X	X		X
PB066	PB066-1SS0##-N	0-10	13831282.56	3201430.52	X	X	X	X	X	X	X	X	X			
PB069	PB069-1SS0##-N	0-10	13830951.45	3201176.75	X	X	X	X	X	X	X	X	X	X	X	X
PB074	PB074-1SS0##-N	0-10	13830590.51	3200920.74	X	X	X	X	X	X	X	X	X			
PB081	PB081-1SS0##-N	0-10	13830053.82	3200762.26	X	X	X	X	X	X	X	X	X	X		X
PB087	PB087-1SS0##-N	0-10	13829462.69	3200863.63	X	X	X	X	X	X	X	X	X			
PB093	PB093-1SS0##-N	0-10	13828939.03	3200964.52	X	X	X	X	X	X	X	X	X	X		X
PB097	PB097-1SS0##-N	0-10	13828549.34	3201121.96	X	X	X	X	X	X	X	X	X			
PB101	PB101-1SS0##-N	0-10	13828172.10	3201306.66	X	X	X	X	X	X	X	X	X	X		X
Field Quality Assurance /Quality Control Samples																
PB#### ^d	PB####-#XX###-D		TBD	TBD	X	X	X	X	X	X	X	X	X	X	X	X
PB#### ^d	PB####-#XX###-D		TBD	TBD	X	X	X	X	X	X	X	X	X			
PB#### ^d	PB####-#XX###-D		TBD	TBD	X	X	X	X	X	X	X	X	X	X		X
EB/ER ^e	EB#/ER#		NA	NA												
Trip Blank		TB#	NA	NA												

- Notes:
- a Station Coordinates are State Plane coordinates based on North American Datum (NAD) 83 for Texas, South Central
 - b See Table 4 for complete list of analytes/congeners included in analyses
 - c Specific station and interval may be changed in the field to best represent site conditions
 - d Location to be determined in field based on site conditions. Samples to be named in accordance with Section 7.1.1
 - e Equipment blank / Equipment rinsate

* Depth interval will be 0-2cm for AVS/SEM analyses

Table 3
Summary of Surface Water Sampling Study Design

Station ID ^c	Sample ID	Station Coordinates ^a		TDS, TSS	DOC, TOC	Total Phosphorous	TKN	Total Cyanide	Alkalinity	Chloride, Fluoride, Sulfate, Nitrate	Selenium	Mercury	Dioxin/Furans ^b	PCB Congeners ^b	SVOCs ^b	VOCs ^b	Pesticides ^b
		Northing	Easting														
HSC14	HSC14-1SW###-N	13836967.31	3201202.15	X	X	X	X	X	X	X	X	X	X	X	X	X	X
PB006	PB006-1SW###-N	13836270.13	3202141.40	X	X	X	X	X	X	X	X	X	X	X	X	X	X
PB031	PB031-1SW###-N	13834635.95	3201366.87	X	X	X	X	X	X	X	X	X	X	X	X	X	X
PB076	PB076-1SW###-N	13830445.02	3200824.30	X	X	X	X	X	X	X	X	X	X	X	X	X	X
PB059	PB059-1SW###-N	13831834.16	3201585.76	X	X	X	X	X	X	X	X	X	X	X	X	X	X
PB119	PB119-1SW###-N	13826366.81	3201517.01	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Field Quality Assurance / Quality Control Samples																	
PB### ^c	PB###-XX###-D	TBD	TBD	X	X	X	X	X	X	X	X	X	X	X	X	X	X

Notes:

- a Station Coordinates are State Plane coordinates based on North American Datum (NAD) 83 for Texas, South Central
- b See Table 5 for complete list of analytes/congeners included in analyses
- c Location to be determined in field based on site conditions. Samples to be named in accordance with Section 5.1.1

Table 4
Parameters for Analysis and Target Practical Quantitation Limits for Sediment

	Units ^a	Sediment Target PQL	Analytical Method	Analytical Concentration Goal	
				TCEQ Ecological Sediment Primary Benchmark ^b	Bioaccumulation ^c
Conventional Parameters					
Ammonia	mg/kg	0.1	350.1		--
Grain Size	%	0.1	ASTM D422		--
Specific Gravity	--		ASTM D854		--
Total Organic Carbon	%	0.02	9060/415.1		--
AVS/SEM					
Acid Volatile Sulfide	mg/kg	1.0	EPA Draft 1991/376.2		--
SEM Cadmium	mg/kg	1.0	EPA Draft 1991/376.2		--
SEM Copper	mg/kg	1.0	EPA Draft 1991/376.2		--
SEM Lead	mg/kg	1.0	EPA Draft 1991/376.2		--
SEM Mercury	mg/kg	1.0	EPA Draft 1991/376.2		--
SEM Nickel	mg/kg	1.0	EPA Draft 1991/376.2		--
SEM Silver	mg/kg	1.0	EPA Draft 1991/376.2		--
SEM Zinc	mg/kg	1.0	EPA Draft 1991/376.2		--
Metals					
Mercury	mg/kg	0.05	7470A/7471A	0.15	0.02
Arsenic	mg/Kg	0.2	6010B/6020	8.2	12.2
Cadmium	mg/kg	0.2	6010B/6020	1.2	21.46
Chromium	mg/kg	0.5	6010B/6020	81	14
Copper	mg/kg	0.5	6010B/6020	34	149
Lead	mg/kg	1.0	6010B/6020	46.7	33
Nickel	mg/kg	0.5	6010B/6020	20.9	255.8
Selenium	mg/kg	0.5	6010B/6020		1.13
Zinc	mg/kg	4.0	6010B/6020	150	305
Semivolatile Organics					
LPAH					
2-Methylnaphthalene	µg/kg	6.7	8270C/ SIM	70	13800
Acenaphthene	µg/kg	6.7	8270C/ SIM	16	8490
Acenaphthylene	µg/kg	6.7	8270C/ SIM	44	13470
Anthracene	µg/kg	6.7	8270C/ SIM	85.3	15150
Fluorene	µg/kg	6.7	8270C/ SIM	19	13050
Naphthalene	µg/kg	6.7	8270C/ SIM	160	15200
Phenanthrene	µg/kg	6.7	8270C/ SIM	240	12600
HPAH					
Benzo(a)anthracene	µg/kg	6.7	8270C/ SIM	261	179380
Benzo(a)pyrene	µg/kg	6.7	8270C/ SIM	430	205960
Benzo(b)fluoranthene	µg/kg	6.7	8270C/ SIM		217450
Benzo(e)pyrene	µg/kg	6.7	8270C/ SIM		
Benzo(g,h,i)perylene	µg/kg	6.7	8270C/ SIM		214910

Table 4
Parameters for Analysis and Target Practical Quantitation Limits for Sediment

	Units ^a	Sediment Target PQL	Analytical Method	Analytical Concentration Goal	
				TCEQ Ecological Sediment Primary Benchmark ^b	Bioaccumulation ^c
Benzo(k)fluoranthene	µg/kg	6.7	8270C/ SIM		214190
Chrysene	µg/kg	6.7	8270C/ SIM	384	188310
Dibenzo(a,h)anthracene	µg/kg	6.7	8270C/ SIM	63.4	221950
Indeno(1,2,3-cd)pyrene	µg/kg	6.7	8270C/ SIM		217634
Fluoranthene	µg/kg	6.7	8270C/ SIM	600	199570
Perylene	µg/kg	6.7	8270C/ SIM		
Pyrene	µg/kg	6.7	8270C/ SIM	665	11200
Alkyl-substituted PAH homologs					
C1-Chrysenes	µg/kg	63	8270C/ SIM		--
C1-Fluoranthene/Pyrene	µg/kg	63	8270C/ SIM		--
C1-Fluorenes	µg/kg	63	8270C/ SIM		--
C1-Naphthalenes	µg/kg	63	8270C/ SIM		--
C1-Phenanthrenes/Anthracenes	µg/kg	63	8270C/ SIM		--
C2-Chrysenes	µg/kg	63	8270C/ SIM		--
C2-Fluorenes	µg/kg	63	8270C/ SIM		--
C2-Naphthalenes	µg/kg	63	8270C/ SIM		--
C2-Phenanthrenes/Anthracenes	µg/kg	63	8270C/ SIM		--
C3-Chrysenes	µg/kg	63	8270C/ SIM		--
C3-Fluorenes	µg/kg	63	8270C/ SIM		--
C3-Naphthalenes	µg/kg	63	8270C/ SIM		--
C3-Phenanthrenes/Anthracenes	µg/kg	63	8270C/ SIM		--
C4-Chrysenes	µg/kg	63	8270C/ SIM		--
C4-Naphthalenes	µg/kg	63	8270C/ SIM		--
C4-Phenanthrenes/Anthracenes	µg/kg	63	8270C/ SIM		--
Other Semivolatile Organics					
bis(2-Ethylhexyl)phthalate	µg/kg	67	8270C/ SIM	182	16240
Hexachlorobutadiene	µg/kg	6.7	8270C/ SIM	20	10600
Hexachlorobenzene	µg/kg	67.0	8270C/ SIM		2700
Benzidine	µg/kg	670	8270C/ SIM		--
bis(2-Chloroisopropyl)ether	µg/kg	67	8270C/ SIM		--
Hexachloroethane	µg/kg	6.7	8270C/ SIM	180	2500
Di-n-octylphthalate	µg/kg	67	8270C/ SIM		--
Volatile Organics					
1,2-Dichlorobenzene	µg/kg	1.0	8260B	740	2310
Benzene	µg/kg	1.0	8260B	140	--
Isopropylbenzene	µg/kg	1.0	8260B		--
o-Xylene	µg/kg	1.0	8260B	2540	--
m,p-Xylene	µg/kg	1.0	8260B	2540	--
1,3-Dichlorobenzene	µg/kg	1.0	8260B	320	1970
1,4-Dichlorobenzene	µg/kg	1.0	8260B	700	1640

Table 4
Parameters for Analysis and Target Practical Quantitation Limits for Sediment

	Units ^a	Sediment Target PQL	Analytical Method	Analytical Concentration Goal	
				TCEQ Ecological Sediment Primary Benchmark ^b	Bioaccumulation ^c
4-Isopropyltoluene	µg/kg	1.0	8260B		--
Chlorobenzene	µg/kg	1.0	8260B	290	--
Ethylbenzene	µg/kg	1.0	8260B	650	--
n-Butylbenzene	µg/kg	1.0	8260B		--
n-Propylbenzene	µg/kg	1.0	8260B		--
sec-Butylbenzene	µg/kg	1.0	8260B		--
tert-Butylbenzene	µg/kg	1.0	8260B		--
Toluene	µg/kg	1.0	8260B	940	--
PCBs					
PCB Congeners 1-209	pg/g	10	1668	22700 ^d	--
Pesticides					
2,4'-DDD	µg/kg	2.0	8081A	1.22	-- *
2,4'-DDE	µg/kg	2.0	8081A	2.1	--
2,4'-DDT	µg/kg	2.0	8081A	1.2	-- *
4,4'-DDD	µg/kg	2.0	8081A	1.22	22.7 *
4,4'-DDE	µg/kg	2.0	8081A	2.1	20
4,4'-DDT	µg/kg	2.0	8081A	1.2	27 *
Aldrin	µg/kg	1.0	8081A		490.5
alpha Chlordane	µg/kg	1.0	8081A	2.26	7876
gamma Chlordane	µg/kg	1.0	8081A	2.26	14141
Endosulfan I	µg/kg	1.0	8081A		2593
Endosulfan II	µg/kg	2.0	8081A		2760
Endrin	µg/kg	2.0	8081A		116.7
gamma-BHC (Lindane)	µg/kg	1.0	8081A	0.32	20181 *
Heptachlor Epoxide	µg/kg	1.0	8081A		2468
Methoxychlor	µg/kg	10.0	8081A		95322
Dioxins and Furans					
1,2,3,4,6,7,8-HpCDD	pg/g	2.5	1613B		--
1,2,3,4,6,7,8-HpCDF	pg/g	2.5	1613B		--
1,2,3,4,7,8,9-HpCDF	pg/g	2.5	1613B		--
1,2,3,4,7,8-HxCDD	pg/g	2.5	1613B		--
1,2,3,4,7,8-HxCDF	pg/g	2.5	1613B		--
1,2,3,6,7,8-HxCDD	pg/g	2.5	1613B		--
1,2,3,6,7,8-HxCDF	pg/g	2.5	1613B		--
1,2,3,7,8,9-HxCDD	pg/g	2.5	1613B		--
1,2,3,7,8,9-HxCDF	pg/g	2.5	1613B		--
1,2,3,7,8-PeCDD	pg/g	2.5	1613B		--
1,2,3,7,8-PeCDF	pg/g	2.5	1613B		--
2,3,4,6,7,8-HxCDF	pg/g	2.5	1613B		--
2,3,4,7,8-PeCDF	pg/g	2.5	1613B		--

Table 4
Parameters for Analysis and Target Practical Quantitation Limits for Sediment

				Analytical Concentration Goal	
				TCEQ Ecological Sediment Primary Benchmark ^b	Bioaccumulation ^c
2,3,7,8-TCDD	pg/g	0.5	1613B		193
2,3,7,8-TCDF	pg/g	0.5	1613B		--
OCDD	pg/g	5.0	1613B		--
OCDF	pg/g	5.0	1613B		--

Notes:

a - All chemical concentrations to be determined on a dry weight basis.

b - TCEQ (2006). Update to Guidance for Conducting Ecological Risk Assessments at Remediation Sites in Texas RG-263 (Revised)

c - Sediment concentration corresponding to HQLOAEL = 1.0 using risk models for river otter and spotted sandpiper (Anchor 2008). Value is lowest concentration of the two models.

d - Based on Total PCB value. Equivalent to approximately 109 pg/g for each of 209 congeners

* Sediment target PQL exceeds TCEQ Benchmark but is below the respective TCEQ Secondary Effects Level

ERL - Effects Range Low

ERM - Effects Range Medium

PEL - Probable Effects Level

NA - Not applicable

PQL - Practical quantitation limit

µg/kg - micrograms per kilogram

pg/g - picograms per gram

TEL - Threshold Effects Level (for Marine Sediment)

-- - Not Available

Table 5
Parameters for Analysis and Target Practical Quantitation Limits for Surface Water

	Units	Detection Limit	Analytical Method	Analytical Concentration Goal ^a
Conventional Parameters				
Alkalinity	mg/L	1.0	310.2	--
Chloride	mg/L	1.0	300	--
Dissolved Organic Carbon	mg/L	1.5	9060	--
Fluoride	mg/L	0.1	300	--
Nitrate	mg-N/L	0.01	SM-4500-NO3	--
Sulfate	mg/L	2.0	300	--
Total Cyanide	mg/L	0.005	335.4	--
Total Dissolved Solids	mg/L	5.0	SM-2540C	--
Total Kjeldahl Nitrogen, Total	mg/L	0.6	351.4	--
Total Organic Carbon	mg/L	1.5	9060	--
Total Phosphorus	mg/L		365.3	--
Total Suspended Solids	mg/L	1.0	SM-2540C	--
Metals				
Mercury, total	µg/L	0.1	7470A	1.1
Mercury, dissolved	µg/L	0.1	7470A	--
Selenium, total	µg/L	0.5	6010B/6020	136
Selenium, dissolved	µg/L	0.5	6010B/6020	--
Semivolatile Organics				
1,1'-Biphenyl	µg/L	1.0	8270C	--
1,2,4,5-Tetrachlorobenzene	µg/L	1.0	8270C	129
2,2'-Oxybis(1-chloropropane)	µg/L	1.0	8270C	--
2,3,4,6-Tetrachlorophenol	µg/L	1.0	8270C	--
2,4,5-Trichlorophenol	µg/L	5.0	8270C	12
2,4,6-Trichlorophenol	µg/L	5.0	8270C	61
2,4-Dichlorophenol	µg/L	5.0	8270C	--
2,4-Dimethylphenol	µg/L	1.0	8270C	--
2,4-Dinitrophenol	µg/L	10.0	8270C	670
2,4-Dinitrotoluene	µg/L	1.0	8270C	--
2,6-Dinitrotoluene	µg/L	5.0	8270C	--
2-Chloronaphthalene	µg/L	1.0	8270C	--
2-Chlorophenol	µg/L	1.0	8270C	265
2-Methylnaphthalene	µg/L	1.0	8270C	30
2-Methylphenol	µg/L	1.0	8270C	510
2-Nitroaniline	µg/L	5.0	8270C	--
2-Nitrophenol	µg/L	1.0	8270C	1470
3,3'-Dichlorobenzidine	µg/L	5.0	8270C	37
3-Nitroaniline	µg/L	5.0	8270C	--
4,6-Dinitro-2-methylphenol	µg/L	10.0	8270C	--
4-Bromophenyl-phenylether	µg/L	1.0	8270C	--

Table 5
Parameters for Analysis and Target Practical Quantitation Limits for Surface Water

	Units	Detection Limit	Analytical Method	Analytical Concentration Goal ^a
4-Chloro-3-methylphenol	µg/L	5.0	8270C	--
4-Chloroaniline	µg/L	5.0	8270C	--
4-Chlorophenyl-phenyl ether	µg/L	1.0	8270C	--
3 & 4-Methylphenol	µg/L	1.0	8270C	--
4-Nitroaniline	µg/L	5.0	8270C	--
4-Nitrophenol	µg/L	5.0	8270C	359
Acenaphthene	µg/L	1.0	8270C	40.4
Acenaphthylene	µg/L	1.0	8270C	--
Acetophenone	µg/L	1.0	8270C	--
Anthracene	µg/L	0.1	8270C	0.18
Atrazine	µg/L	1.0	8270C	--
Benzo(a) pyrene	µg/L	1.0	8270C	--
Benzo(a)anthracene	µg/L	1.0	8270C	--
Benzo(b) fluoranthene	µg/L	1.0	8270C	--
Benzo(g,h,i) perylene	µg/L	1.0	8270C	--
Benzo(k) fluoranthene	µg/L	1.0	8270C	--
Bis(2-chloroethoxy) methane	µg/L	1.0	8270C	--
Bis(2-chloroethyl) ether	µg/L	1.0	8270C	--
Bis(2-ethylhexyl) phthalate	µg/L	1.0	8270C	--
Butylbenzylphthalate	µg/L	1.0	8270C	147
Caprolactam	µg/L	1.0	8270C	--
Carbazole	µg/L	1.0	8270C	--
Chrysene	µg/L	1.0	8270C	--
Dibenzo(a,h) anthracene	µg/L	1.0	8270C	--
Dibenzofuran	µg/L	1.0	8270C	65
Diethylphthalate	µg/L	1.0	8270C	442
Dimethylphthalate	µg/L	1.0	8270C	580
Di-n-butylphthalate	µg/L	1.0	8270C	5
Di-n-octylphthalate	µg/L	1.0	8270C	--
Fluoranthene	µg/L	1.0	8270C	2.96
Fluorene	µg/L	1.0	8270C	50
Hexachlorocyclopentadiene	µg/L	5.0	8270C	--
Indeno(1,2,3,-cd) pyrene	µg/L	1.0	8270C	--
Isophorone	µg/L	1.0	8270C	650
Naphthalene	µg/L	1.0	8270C	125
Nitrobenzene	µg/L	1.0	8270C	66.8
N-Nitroso-di-n propylamine	µg/L	5.0	8270C	120
N-Nitrosodiphenylamine	µg/L	1.0	8270C	165000
Pentachlorophenol	µg/L	10.0	8270C	9.6
Phenanthrene	µg/L	1.0	8270C	4.6
Pyrene	µg/L	0.1	8270C	0.24

Table 5
Parameters for Analysis and Target Practical Quantitation Limits for Surface Water

	Units	Detection Limit	Analytical Method	Analytical Concentration Goal ^a
VOCs				
1,1,1-Trichloroethane	µg/L	1.0	8260B	1560
1,1,2,2-Tetrachloroethane	µg/L	1.0	8260B	451
1,1,2-Trichloro-1,2,2-trifluoroethane	µg/L	2.0	8260B	--
1,1,2-Trichloroethane	µg/L	1.0	8260B	275
1,1-Dichloroethane	µg/L	1.0	8260B	--
1,1-Dichloroethene	µg/L	1.0	8260B	12500
1,2,3-Trichlorobenzene	µg/L	5.0	8260B	--
1,2,4-Trichlorobenzene	µg/L	5.0	8260B	22
1,2-Dibromo-3-chloropropane	µg/L	5.0	8260B	--
1,2-Dibromoethane	µg/L	1.0	8260B	--
1,2-Dichlorobenzene	µg/L	1.0	8260B	99
1,2-Dichloroethane	µg/L	1.0	8260B	5650
1,2-Dichloropropane	µg/L	1.0	8260B	2400
1,3-Dichlorobenzene	µg/L	1.0	8260B	142
1,4-Dichlorobenzene	µg/L	1.0	8260B	99
2-Butanone	µg/L	5.0	8260B	--
2-Hexanone	µg/L	5.0	8260B	--
4-Methyl-2-pentanone	µg/L	5.0	8260B	61500
Acetone	µg/L	5.0	8260B	282000
Benzene	µg/L	1.0	8260B	109
Bromochloromethane	µg/L	1.0	8260B	--
Bromodichloromethane	µg/L	1.0	8260B	--
Bromoform	µg/L	1.0	8260B	--
Bromomethane	µg/L	1.0	8260B	600
Carbon disulfide	µg/L	1.0	8260B	--
Carbon tetrachloride	µg/L	1.0	8260B	1500
Chlorobenzene	µg/L	1.0	8260B	105
Chloroethane	µg/L	1.0	8260B	--
Chloroform	µg/L	1.0	8260B	4100
Chloromethane	µg/L	1.0	8260B	13500
cis-1,2-Dichloroethene	µg/L	1.0	8260B	--
cis-1,3-Dichloropropane	µg/L	1.0	8260B	--
Cyclohexane	µg/L	1.0	8260B	--
Dibromochloromethane	µg/L	1.0	8260B	--
Dichlorodifluoromethane	µg/L	1.0	8260B	--
Ethylbenzene	µg/L	1.0	8260B	249
Isopropylbenzene	µg/L	1.0	8260B	--
m,p-Xylene	µg/L	2.0	8260B	--
Methyl acetate	µg/L	1.0	8260B	--
Methyl tert-butyl ether	µg/L	1.0	8260B	--

Table 5
Parameters for Analysis and Target Practical Quantitation Limits for Surface Water

	Units	Detection Limit	Analytical Method	Analytical Concentration Goal ^a
Methylcyclohexane	µg/L	1.0	8260B	--
Methylene chloride	µg/L	2.0	8260B	5420
o-Xylene	µg/L	1.0	8260B	--
Styrene	µg/L	1.0	8260B	455
Tetrachloroethene	µg/L	1.0	8260B	1450
Toluene	µg/L	1.0	8260B	480
trans-1,2-Dichloroethene	µg/L	1.0	8260B	--
trans-1,3-Dichloropropene	µg/L	1.0	8260B	--
Trichloroethene	µg/L	1.0	8260B	970
Trichlorofluoromethane	µg/L	1.0	8260B	--
Vinyl chloride	µg/L	1.0	8260B	--
Pesticides and other SVOC				
4,4'-DDD	µg/L	0.0005	8081A	0.025
4,4'-DDE	µg/L	0.0005	8081A	0.14
4,4'-DDT	µg/L	0.0005	8081A	0.001
Aldrin	µg/L	0.01	8081A	0.13 *
alpha-BHC	µg/L	0.01	8081A	25
alpha-Chlordane	µg/L	0.01	8081A	--
beta-BHC	µg/L	0.01	8081A	--
delta-BHC	µg/L	0.01	8081A	--
Dieldrin	µg/L	0.02	8081A	0.002 *
Endosulfan I	µg/L	0.01	8081A	0.009 *
Endosulfan II	µg/L	0.02	8081A	0.009 *
Endosulfan sulfate	µg/L	0.02	8081A	0.009 *
Endrin	µg/L	0.02	8081A	0.002 *
Endrin aldehyde	µg/L	0.02	8081A	--
Endrin ketone	µg/L	0.02	8081A	--
gamma-BHC (Lindane)	µg/L	0.01	8081A	0.016
gamma-Chlordane	µg/L	0.01	8081A	--
Heptachlor	µg/L	0.01	8081A	0.004 *
Heptachlor epoxide	µg/L	0.01	8081A	0.0036 *
Hexachlorobenzene	µg/L	0.01	8270C	--
Hexachlorobutadiene	µg/L	0.1	8270C	0.32
Hexachloroethane	µg/L	1	8270C	9.4
Methoxychlor	µg/L	0.1	8081A	0.03
Toxaphene	µg/L	1	8081A	0.0002 *
PCBs				
PCB Congeners 1-209	ng/L	10.0	1668	30 ^b
Dioxin/Furan				
1,2,3,4,6,7,8-HpCDD	pg/L	25	1613B	--
1,2,3,4,6,7,8-HpCDF	pg/L	25	1613B	--

Table 5
Parameters for Analysis and Target Practical Quantitation Limits for Surface Water

	Units	Detection Limit	Analytical Method	Analytical Concentration Goal ^a
1,2,3,4,7,8,9-HpCDF	pg/L	25	1613B	--
1,2,3,4,7,8-HxCDD	pg/L	25	1613B	--
1,2,3,4,7,8-HxCDF	pg/L	25	1613B	--
1,2,3,6,7,8-HxCDD	pg/L	25	1613B	--
1,2,3,6,7,8-HxCDF	pg/L	25	1613B	--
1,2,3,7,8,9-HxCDD	pg/L	25	1613B	--
1,2,3,7,8,9-HxCDF	pg/L	25	1613B	--
1,2,3,7,8-PeCDD	pg/L	25	1613B	--
1,2,3,7,8-PeCDF	pg/L	25	1613B	--
2,3,4,6,7,8-HxCDF	pg/L	25	1613B	--
2,3,4,7,8,-PeCDF	pg/L	25	1613B	--
2,3,7,8-TCDD	pg/L	5.0	1613B	--
2,3,7,8-TCDF	pg/L	5.0	1613B	--
OCDD	pg/L	50	1613B	--
OCDF	pg/L	50	1613B	--

Notes:

- a TCEQ (2006) ecological screening benchmark for marine waters
- b Based on total PCBs; individual congener ACG are approximately 0.3 ng/L to meet total ACG
- * Target PQL exceeds ACG but is less than the TCEQ Marine Acute WQC
- mg-N/L Milligrams nitrogen per liter
- mg/L Milligrams per liter
- µg/L Micrograms per liter
- ng/L Nanograms per liter

Table 6
Laboratory Quality Control Sample Summary for Sediment

Analysis Type	Initial Calibration	Ongoing Calibration	Replicates	Matrix Spikes	SRM/LCS	Matrix Spike Duplicates	Method Blanks	Surrogate Spikes
Grain size	Each batch ^a	NA	1 per 20 samples	NA	NA	NA	NA	NA
Specific Gravity	Each batch ^a	NA	1 per 20 samples	NA	NA	NA	NA	NA
Total organic carbon	Daily or each batch	1 per 10 samples	1 per 20 samples	1 per 20 samples	1 per 20 samples	NA	1 per 20 samples	NA
Ammonia	Each batch ^b	1 per 10 samples	1 per 20 samples	1 per 20 samples	1 per 20 samples	NA	1 per 20 samples	NA
Acid Volatile Sulfides	Each batch ^b	1 per 10 samples	1 per 20 samples	1 per 20 samples	1 per 20 samples	NA	1 per 20 samples	NA
Metals	Daily	1 per 10 samples	1 per 20 samples	1 per 20 samples	1 per 20 samples	NA	1 per 20 samples	NA
Mercury	Daily	1 per 10 samples	1 per 20 samples	1 per 20 samples	1 per 20 samples	NA	1 per 20 samples	NA
Dioxin/Furans	As needed ^c	Every 12 hours	NA	NA ^d	NA ^d	NA ^d	1 per 20 samples	NA ^d
PCB Congeners	As needed ^c	Every 12 hours	NA	NA ^d	NA ^d	NA ^d	1 per 20 samples	NA ^d
Semivolatile organics	As needed ^c	Every 12 hours	NA	1 per 20 samples	1 per 20 samples	1 per 20 samples	1 per 20 samples	Every sample
Pesticides ^e	As needed ^c	1 per 10 samples	NA	1 per 20 samples	1 per 20 samples	1 per 20 samples	1 per 20 samples	Every sample
Volatile organics	As needed ^c	Every 12 hours	NA	1 per 20 samples	1 per 20 samples	1 per 20 samples	1 per 20 samples	Every sample

Notes:

- a Calibration and certification of drying ovens and weighing scales are conducted bi-annually
- b Initial calibration verification and calibration blank must be analyzed at the beginning of each batch
- c Initial calibrations are considered valid until the ongoing continuing calibration no longer meets method specifications. At that point, a new initial calibration is performed
- d Isotope dilution required per method
- e Pesticides will have all detects confirmed via second column confirmation. The second column must be of a dissimilar stationary phase from the primary column and meet all method requirements for acceptance
- NA Not Applicable
- SRM Standard reference material
- LCS Laboratory control sample

Table 7
Laboratory Quality Control Sample Summary for Surface Water

Analysis Type	Initial Calibration	Ongoing Calibration	Replicates	Matrix Spikes	SRM/LCS	Matrix Spike Duplicates	Method Blanks	Surrogate Spikes
TDS/TSS	Each batch ^b	NA	1 per 20 samples	NA	NA	NA	NA	NA
Alkalinity	Each batch ^b	NA	1 per 20 samples	1 per 20 samples	1 per 20 samples	NA	1 per 20 samples	NA
TP, DOC, TOC, CN, TKN	Each batch ^b	1 per 10 samples	1 per 20 samples	1 per 20 samples	1 per 20 samples	NA	1 per 20 samples	NA
Chloride, Fluoride, Nitrate, Sulfate	Each batch ^b	1 per 10 samples	1 per 20 samples	1 per 20 samples	1 per 20 samples	NA	1 per 20 samples	NA
Metals	Daily	1 per 10 samples	1 per 20 samples	1 per 20 samples	1 per 20 samples	NA	1 per 20 samples	NA
Dioxin/Furans	As needed ^c	Every 12 hours	NA	NA ^d	NA ^d	NA ^d	1 per 20 samples	NA ^d
PCB Congeners	As needed ^c	Every 12 hours	NA	NA ^d	NA ^d	NA ^d	1 per 20 samples	NA ^d
Semivolatile organics	As needed ^c	Every 12 hours	NA	1 per 20 samples	1 per 20 samples	1 per 20 samples	1 per 20 samples	Every sample
Pesticides ^e	As needed ^c	1 per 10 samples	NA	1 per 20 samples	1 per 20 samples	1 per 20 samples	1 per 20 samples	Every sample
Volatile organics	As needed ^c	Every 12 hours	NA	1 per 20 samples	1 per 20 samples	1 per 20 samples	1 per 20 samples	Every sample

Notes:

- a Calibration and certification of drying ovens and weighing scales are conducted bi-annually.
 - b Initial calibration verification and calibration blank must be analyzed at the beginning of each batch.
 - c Initial calibrations are considered valid until the ongoing continuing calibration no longer meets method specifications. At that point, a new initial calibration is performed.
 - d Isotope dilution required per method
 - e Pesticides will have all detects confirmed via second column confirmation. The second column must be of a dissimilar stationary phase from the primary column and meet all method requirements for acceptance.
- NA Not Applicable
SRM Standard reference material
LCS Laboratory control sample

Table 8
Laboratory Measurement Objectives for Sediment Samples

Parameter	Precision	Accuracy	Completeness
Grain size	±20% RPD	NA	95%
Specific Gravity	±20% RPD	NA	95%
Total organic carbon	±20% RPD	75-125% R	95%
Ammonia	±20% RPD	75-125% R	95%
Acid Volatile Sulfides	±20% RPD	75-125% R	95%
Metals	± 30% RPD	75-125% R	95%
Mercury	± 30% RPD	75-125% R	95%
Dioxin/Furans	± 35% RPD	50-150% R	95%
PCB Congeners	± 35% RPD	50-150% R	95%
Semivolatile organics	± 35% RPD	50-150% R	95%
Pesticides	± 35% RPD	50-150% R	95%
Volatile organics	± 35% RPD	50-150% R	95%

Notes:

RPD Relative percent difference

R Recovery

Table 9
Laboratory Measurement Objectives for Surface Water Samples

Parameter	Precision	Accuracy	Completeness
TDS/TSS	±20% RPD	NA	95%
Alkalinity	±20% RPD	80-120% R	95%
TP, DOC, TOC, CN, TKN	±20% RPD	80-120% R	95%
Chloride, Fluoride, Nitrate, Sulfate	±20% RPD	80-120% R	95%
Metals	± 20% RPD	80-120% R	95%
Dioxin/Furans	± 20% RPD	60-140% R	95%
PCB Congeners	± 30% RPD	60-140% R	95%
Semivolatile organics	± 30% RPD	60-140% R	95%
Volatile organics	± 30% RPD	60-140% R	95%
Pesticides	± 30% RPD	60-140% R	95%

Notes:

RPD Relative percent difference

R Recovery

Table 10
Sediment Sample Containers, Preservatives, and Holding Times

Parameter	Sample Size	Container Size and Type	Holding Time	Sample Preservation Technique
Acid Volatile Sulfides/ Simultaneous Extracted Metals	50 g	4-oz Glass, no headspace	14 days	Cool/4° C
Total metals (with Hg)	50 g	4-oz Glass	6 months; 28 days for Hg	Cool/4° C
			2 years (except Hg)	Freeze -18°C
Volatile organic compounds	100 g	2 2-oz Glass	14 days	Zero head space/ Cool/4° C
Semivolatile organic compounds	150 g	16-oz Glass	14 days until extraction	Cool/4° C
			1 year until extraction	Freeze -18°C
			40 days after extraction	Cool/4° C
Pesticides	150 g	from SVOC container	14 days until extraction	Cool/4° C
			1 year until extraction	Freeze -18°C
			40 days after extraction	Cool/4° C
Total solids (TS)	50 g	4-oz Glass	14 days	Cool/4° C
			6 months	Freeze -18°C
Ammonia	40 g	from TS container	7 days	Cool/4° C
Total organic carbon	50 g	from TS container	14 days	Cool/4° C
			6 months	Freeze -18°C
Dioxins/Furans	150 g	8-oz Glass	1 year to extraction	Freeze -10°C
			1 year after extraction	Freeze -10°C
PCB Congeners	150 g	8-oz Glass	1 year to extraction	Freeze -10°C
			1 year after extraction	Freeze -10°C
Grain size (GS)	300 g	16-oz HDPE	--	--
Specific Gravity	100 g	from GS	6 months	--

Notes:

-- Not Available

Table 11
Surface Water Sample Containers, Preservatives, and Holding Times

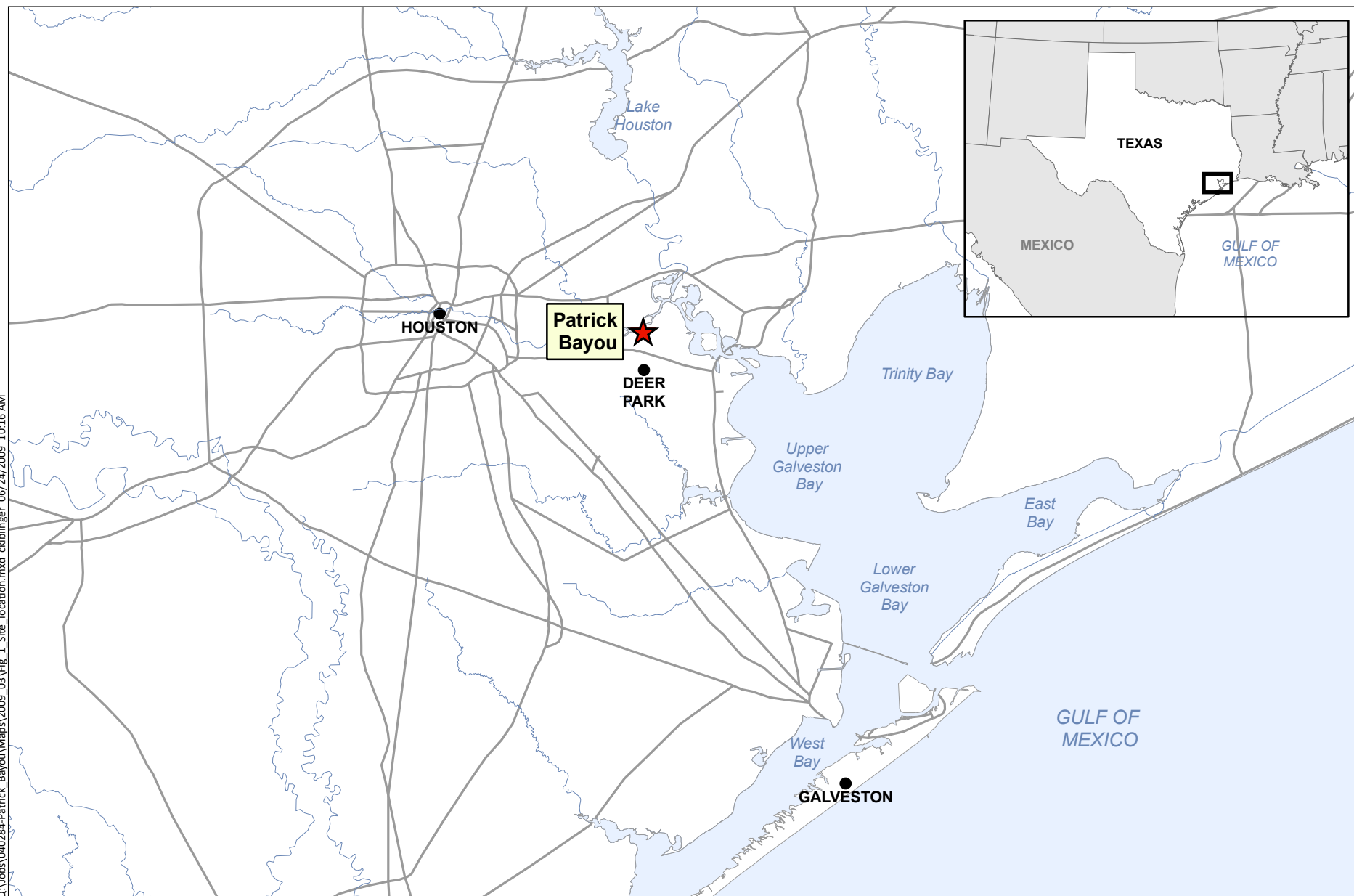
Parameter	Container Size and Type	Holding Time	Preservative
Total Dissolved Solids ^a	1 L HDPE	7 days	Cool/4° C
Total Suspended Solids		7 days	Cool/4° C
Dissolved organic carbon	250 mL AG	28 days	Cool/4° C, H ₂ SO ₄ to pH<2
Total organic carbon	250 mL AG	28 days	Cool/4° C, H ₂ SO ₄ to pH<2
Total phosphorous	500 mL HDPE	28 days	Cool/4° C, H ₂ SO ₄ to pH<2
TKN		28 days	Cool/4° C, H ₂ SO ₄ to pH<2
Total cyanide	500 mL HDPE	14 days	Cool/4° C, NaOH to pH>12
Alkalinity	500 mL HDPE	14 days	Cool/4° C
Chloride, Fluoride, Sulfate		28 days	Cool/4° C
Nitrate		48 hours	Cool/4° C
Metals	500 mL HDPE	6 months	Cool/4° C, HNO ₃ to pH<2
Dioxin/Furans	2 x 500 mL AG	1 year to extraction	Cool/4° C
		1 year after extraction	
PCB Congeners	2 x 500 mL AG	1 year to extraction	Cool/4° C
		1 year after extraction	
SVOCs	2 x 1L AG	7 days until extraction	Cool/4° C
		40 days after extraction	
VOCs	3 x 40 mL VOA vials	14 days	Cool/4° C, HCl to pH<2
Pesticides	2 x 1L AG	7 days until extraction	Cool/4° C
		40 days after extraction	

Notes:

HDPE High density polyethylene
AG Amber glass
a If field filtered, use two bottles

FIGURES

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Surface Sediment COPC Delineation and Surface Water Sampling Work Plan
Patrick Bayou Superfund Site Remedial Investigation, Deer Park, Texas

Figure 1
Site Location



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Station numbers from Patrick Bayou PSCR indicate length along channel in hundreds of feet. Aerial orthoimagery: December 2007.

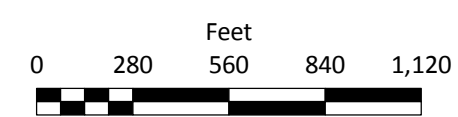
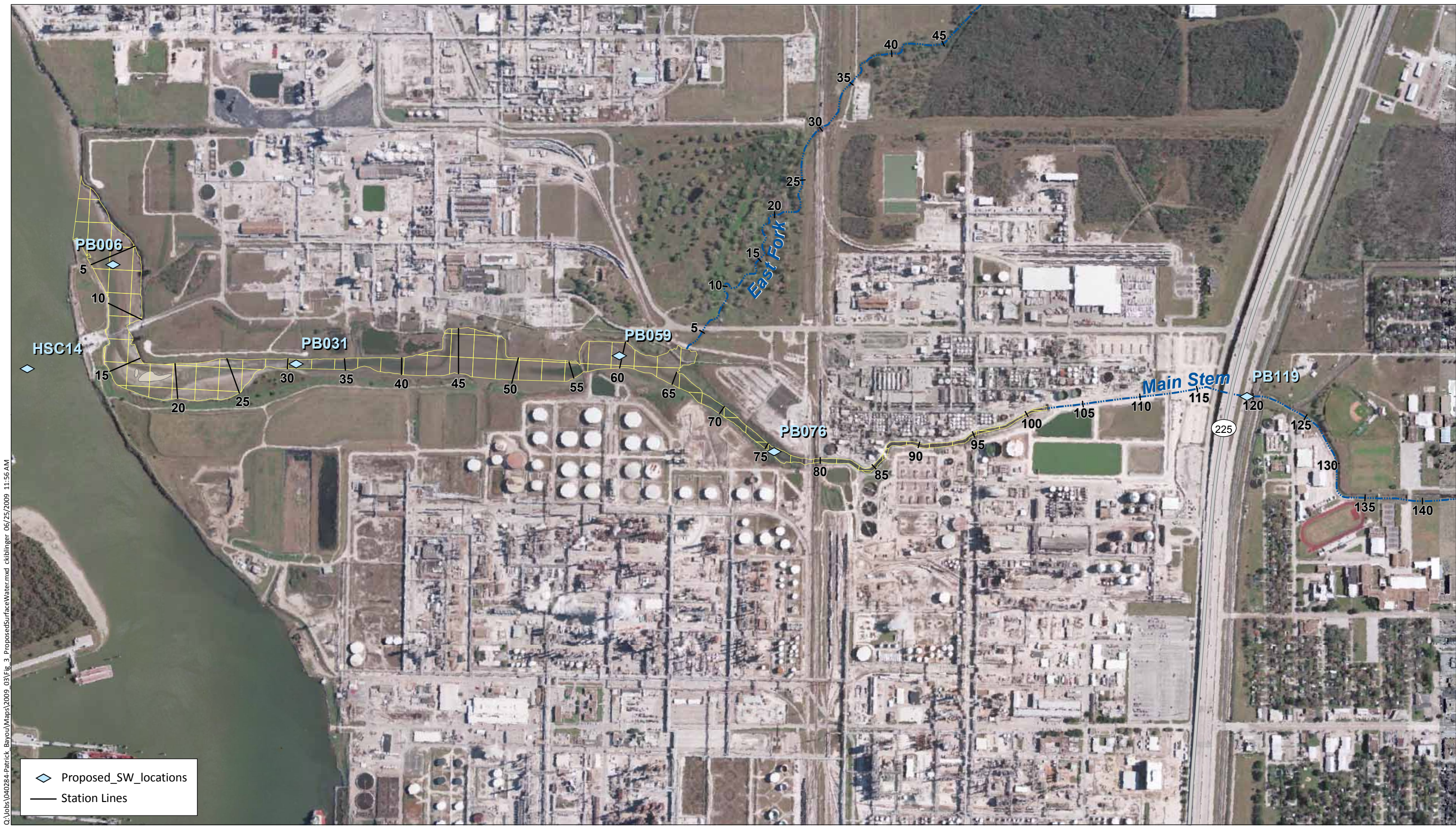


Figure 2
 Proposed Surface Sediment Sampling Locations
 Surface Sediment COPC Delineation and Surface Water Sampling Work Plan
 Patrick Bayou Superfund Site Remedial Investigation, Deer Park, Texas



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Station numbers from Patrick Bayou PSCR indicate length along channel in hundreds of feet. Aerial orthoimagery: December 2007.

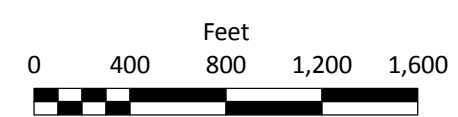


Figure 3
Proposed Surface Water Sampling Location
Surface Sediment COPC Delineation and Surface Water Sampling Work Plan
Patrick Bayou Superfund Site Remedial Investigation, Deer Park, Texas